DaimlerChrysler

Method and system for detecting and/or monitoring wheels of a motor vehicle

The present invention relates to a method for detecting and/or monitoring wheels of a motor vehicle which each comprise at least one tire, according to the features of the preamble of patent claim 1, and a system for detecting and/or monitoring wheels of a motor vehicle which each comprise at least one tire, according to the features of the preamble of patent claim 5.

Such a system is known, for example, from WO 95/22467 and is configured, inter alia, for monitoring the pressure and temperature of a tire which is mounted on a motor vehicle. In this system, a transponder which is connected to a power supply and to an antenna is arranged in or on the material of the tire so that current pressure values and temperature values of the tire can be transmitted in a wire-free fashion in response to an interrogation signal from an interrogation device. In addition to the pressure and the temperature, tire characteristic data is transferred to the interrogation device.

Furthermore, WO 99/29522 discloses a motor vehicle tire which comprises a transponder which is provided with an antenna which surrounds the tire in the circumferential direction. The antenna interacts with a receiver device so that data relating to the tire pressure and the tire temperature as well as tire characteristic data can be transmitted to the receiver device.

DE 199 40 06 A1 discloses a tire for a motor vehicle or an aircraft which comprises a readable and writeable transponder on which data relating to precise identification of the tire on an individual basis is stored, it being possible to read out the data by means

of a reading device. Operational data of the tire, for example pressure values and/or temperature values, can also be stored on the transponder and called by means of the reading device.

WO 99/52724 discloses a system for measuring a pressure of a tire of a motor vehicle. This system comprises a transponder which interacts with an external reading/interrogation unit so that a pressure which prevails in the tire can be continuously monitored. The interrogation unit, which interacts with the transponder in a wire-free fashion, has a display which displays the current pressure value of the respective pressure-monitored tire to a user of the respective motor vehicle.

The invention is based on the object of providing a method and a system for the optimized use of tire-specific data.

This object is achieved by a method having the features of patent claim 1 and by a system having the features of patent claim 5.

When the method or the system according to the invention is used, the tire-specific data can therefore be made available to other systems of the motor vehicle by employing the further processing functionality. The electronic data sheet which comprises the tire-specific data can be made available, for example, to an electronic chassis controller and/or an electronic vehicle movement dynamics system of the motor vehicle which can operate in an optimum way given knowledge of this data since the tire-specific data supplies information about the road contact of the wheels. Alternatively, the data sheet can also be made available to a logistic functionality of a vehicle

manufacturer or of a service workshop, in particular for assembly monitoring.

The tire-specific data can comprise, for example, a measuring protocol and/or quality protocol, a statement of a position of the respective tire on the motor vehicle, an identification mark of the respective tire, a type of tire, a tire dimension, a design, a manufacturer, a velocity class, a load-bearing class, a tire profile, material properties, a production works, a country identifier, a manufacturing date and/or a use-by date. Furthermore, the tire-specific data can also comprise current pressure values and/or temperature values of the respective tire.

Direct measurement of the pressure and temperature in the interior of the tire permits full functionality of a tire pressure-monitoring system. By simultaneously measuring the pressure and temperature it becomes possible to determine the air mass flow rate in the respective tire by means of what is referred to as an isochoric evaluation. When the tire pressure drops below a minimum value, the further processing functionality preferably carries out an intervention into a driving control system and/or issues a warning to the driver.

The memory and transmitter devices which are preferably arranged on all the wheels of the respective motor vehicle can either be integrated directly into or onto the tire when the tire is manufactured, for example by inclusion in the vulcanization process, or can be arranged on the rim of the respective wheel. In the latter case, the memory and transmitter devices are integrated, for example, in a valve inset.

When a memory and transmitter device which is vulcanized into the tire material when the tire is

manufactured is used, the tire-specific data which is independent of the running time, i.e. the data which does not vary while the tire is used, is preferably input into the memory and transmitter device when the tire is manufactured. This has the advantage, when the tire is produced and mounted, that the tire information which can be read out by the memory and transmitter device, for example by means of a transponder, can be used in the logistic process both at the tire manufacturer's and at the respective vehicle manufacturer's. For example, automatic identification can take place during the tire-manufacturing process. Quality data, measurement data and test data can also be stored directly in the tire for later use.

With the system and method according to the invention it is possible for the vehicle manufacturer to automatically supply, in a defined fashion, a tire from a specific tire manufacturer, of a specific type and of a specific tire dimension, to a specific vehicle. It is also possible to monitor and document the tires of a vehicle automatically. As a result, manual checking is dispensed with. In addition, an automatic deployment concept for a tire material can be implemented.

When a transponder technology is used there is no need for a separate power supply to the memory and transmitter device. The tire-specific data can be interrogated and evaluated at any time by a vehicle-mounted and also by an external receiver device or reading device.

If the memory and transmitter device is arranged on a rim it is possible, preferably when the tire is mounted, for the fitter of the tire to transfer the tire-specific data which is invariable while the tire is being used to the data memory device. In this case, the memory and transmitter device advantageously

comprises a rewritable memory so that the respective data memory device can be used again in the same way when a new tire is mounted on the same rim.

The further processing functionality of the system or of the method according to the invention is preferably configured in such a way that it influences the driving behavior of the respective motor vehicle. The further processing functionality is, for example, a component of a driving stability functionality or of a vehicle movement dynamics functionality or else of a velocity decreasing functionality. In this way, the driving behavior of the respective motor vehicle can also be influenced as a function, for example, of the type of tire and/or of the tire pressure.

In one specific embodiment of the system or of the method according to the invention, a velocity limitation is set in order to increase the safety when a gradual loss of pressure in a tire is detected. Of course, the driver is also additionally or alternatively informed by means of a visual and/or audible warning signal.

By using the system and/or the method according to the invention it is therefore possible to transmit overall component-specific information of the tires used and of the instantaneous state of the tires to an information system of the respective vehicle and thus to minimize the risk of critical driving situations due to tires, and to optimize the driving behavior of the motor vehicle. This increases the safety of the vehicle occupants. It is thus always possible to inform or warn the driver of a vehicle when there are conditions which can lead to a tire being damaged or destroyed.

It is also conceivable to use the further processing functionality in such a way that pressure values and

temperature values and the running performance of the individual tires which can be respectively detected by means of a code are sensed by suitable long-term observations or long-term recordings which are carried out over the running time of the tire or tires so that the selected velocities can be configured individually in accordance with the temperature loading, which, for example, can lead to an increase in the overall running performance of the tire or tires given a moderate driving style.

Furthermore, overall running time estimations and durability estimations for the individual tires of the motor vehicle can be carried out by means of the further processing functionality on the basis of data which is stored on the memory and transmitter device of the tire or on the memory and evaluation unit of the motor vehicle and can represent tire-specific data or driving data.

The further processing functionality can also be configured in such a way that the mounted and/or the permissible tire dimension is displayed on a combination instrument or vehicle display. When a tire dimension which is unacceptable for the respective motor vehicle is detected, a visual and/or audible warning can be issued.

When a specific type of tire, for example a summer tire, a winter tire, what is referred to as an all-season tire or what is called a run flat tire is detected, the further processing functionality can also activate or deactivate a possibly necessary velocity limiting functionality. This information can also be used in a vehicle movement dynamics system so that characteristics of specific types of tire can be taken into account here. Basically, a so-called speed index which is stored on the memory and transmitter device

can be converted by the further processing functionality into an automatic limiter function and/or information supplied to the driver about a tire-specific permissible maximum speed.

The further processing functionality can also be configured in such a way that what is referred to as a load index, which is stored on the memory and transmitter device, is converted into a warning function if permissible wheel loads are exceeded and thus permissible wheel loads are not exceeded. Information about adapted tire pressures can also always be transmitted to the driver of a vehicle.

Furthermore, the further processing functionality can also issue a warning which informs the driver of a vehicle about defined running distances of the tire or tires being exceeded, on the basis, for example, of excessive stressing. This can be done taking into account the history of the tire or tires, for example of times of high thermal and/or mechanical stresses, a running distance, a pressure history or the like. In this way it is also possible to calculate a residual running distance and display it in a combination instrument or a vehicle display.

Furthermore, by using the system or method according to the invention it is possible to interrogate further design-related properties of the tire system which is used on the respective motor vehicle and to monitor them, specifically in particular with regard to detection of mixed use of tires, use of various designs, for example of summer tires and winter tires, simultaneous use of various makes of tire as well as with regard to correct running direction, as a result of which specific manufacturer requirements of the mounting of the respective tire are checked.

The memory and transmitter device which is used to store the invariable tire-specific data which comprises, for example, the type of tire and the tire manufacturing date can be configured as a passive system, which is fabricated for example using transponder technology or chip technology, or else is an active system which also checks the state of the tire during operation and transfers the data to the receiver device at regular intervals.

When a passive system is used, the invariable tire-specific data is preferably transferred to the corresponding data memory when the respective tire is manufactured. Given an advantageous embodiment, further data, for example in the form of customer-specific starting data, can be input into this memory after the tire has been mounted on a motor vehicle, so that, for example, a uniquely defined assignment of the positions of the tire on the motor vehicle is possible if corresponding hardware conditions are met. At any later time it is also possible to input current tire state data into a passive system, and the energy which is necessary for this can be transmitted from the respective motor vehicle to the tire or tires by means of a transponder or the like via a suitable interface.

If an active system is used, the tire-specific data, which also comprises the pressure and the temperature of the respective tire, is transferred actively, preferably at regular intervals, to the receiver device or the memory and evaluation unit of the motor vehicle. When a transponder technology is used, i.e. a passive system is used, the tire-specific data is read out from the memory and transmitter device by means of a corresponding interrogation device.

The various wheels of the motor vehicle are preferably each assigned a code for transmitting the tire-specific

data so that the vehicle-end memory and control unit can assign the respective data items to the individual wheels in the correct way. This is particularly expedient if the system comprises a central receiver device by means of which the tire-specific data of all the tires of the motor vehicle can be collected. When a passive system is used, the coding is preferably composed of a number string or the like. When an active system is used, the coding is preferably composed of specific uniquely defined transmission frequencies or else PWM signals.

The memory and evaluation unit can be a central electronic control unit of the respective motor vehicle which, is present in the motor vehicle in, for example, the form of a combination instrument or a central computer unit, irrespective of the system according to the invention. The tire-specific data can be stored and processed in the memory and evaluation unit and subsequently made available, for example, by means of full networking which is frequently present in motor vehicles, to the further processing functionality which can be a component of a vehicle movement dynamics system. As a result, optimum, tire-specific adaptation of the vehicle movement dynamic systems can be achieved. For this it is of course possible for corresponding characteristic diagrams to be stored in the control units of the vehicle movement dynamics system.

The memory and transmitter devices of the individual wheels of a motor vehicle can either interact with a common vehicle-mounted receiver device or respectively with a separate receiver device which is preferably arranged in the respectively assigned wheelhouse.

Further advantages and advantageous embodiments of the subject matter according to the invention emerge from the description, the drawing and the patent claims.

An exemplary embodiment of the system according to the invention is illustrated in a schematically simplified form in the drawing and will be explained in more detail in the following description.

The single figure shows a system according to the invention in a motor vehicle in a highly schematic fashion.

The figure is a basic view of a motor vehicle 10 which is embodied as a passenger car and is equipped with a system for detecting and/or monitoring its wheels, in particular its tires 11, 12, 13 and 14. This system comprises, for each of the tires 11 to 14, a memory and transmitter device 15, 16, 17 and 18, which device is vulcanized into the respective tire and in which characteristic data of the respective tire 11, 12, 13 and 14 is stored, said data comprising the type of tire, the tire dimension, the design of the tire, the manufacturer of the tire, the velocity class of the tire, the load-bearing class of the tire, the type of profile of the tire, the properties of the tire material, the manufacturing date of the tire and the use-by date of the tire. The memory and transmitter device is configured using transponder technology. The characteristic data which is invariable over the running time of the tire 11, 12, 13 and 14 is input into the respective memory and transmitter device 15, 16, 17 and 18 by means of a corresponding transmitter device when the tire is manufactured.

The memory and transmitter devices 15 to 18 of the tires 11 to 14 interact in each case with a pressure

and temperature measuring device (not illustrated in more detail here) for the respective tire.

The pressure values and the temperature values of a tire 11, 12, 13 and 14 as well as the characteristic data of this tire each form together a set of tire-specific data.

For the use of the tire-specific data, the memory and transmitter devices 15 to 18 interact with a receiver device 19 by means of which the tire-specific data of the individual tires 11 to 14 can be read jointly.

The receiver device 19 is connected to a memory and evaluation unit 20 in which the tire-specific data which is received from the individual wheels 11 to 14 can be stored. For further processing, the memory and evaluation unit 20 makes available the tire-specific data to a further processing device 21 which is provided with a further processing functionality. The further processing device 21 comprises a driving stability functionality 22 which is connected to a display 24 which is a component of a combination instrument which is integrated into a dashboard of the motor vehicle 10.